

We Claim:

1. An improved phosphor structure for an electroluminescent display, said structure comprising a phosphor laminate of;

- a blue light emitting phosphor thin film layer;

- a fluoride containing layer provided directly adjacent said phosphor thin film layer, wherein said fluoride containing layer is provided on the top and/or bottom of said phosphor thin film layer.

2. The structure of claim 1, wherein said blue light emitting phosphor thin film layer is selected from the group consisting of a rare earth metal activated barium thioaluminate and a rare earth metal activated magnesium barium thioaluminate.

3. The structure of claim 2, wherein said phosphor thin film layer is represented by $Mg_wBa_{x-w}Al_yS_z:Eu$ where $w = 0 - 0.2$, $x = 1.0$, $y = 2.0 - 6.0$ and $z = 4.0 - 10.0$.

4. The structure of claim 3, wherein said fluoride containing layer is selected from aluminum fluoride and alkaline earth fluoride compounds and mixtures thereof.

5. The structure of claim 4, wherein said alkaline earth fluoride compounds are selected from the group consisting of barium fluoride and magnesium fluoride.

6. The structure of claim 4, wherein said fluoride containing layer has a thickness of about 5 nm to about 50 nm.

7. The structure of claim 4, wherein fluorine from said fluoride containing layer may partially infuse into said phosphor thin film layer.

8. The structure of claim 4, wherein said structure comprises a fluoride containing layer on the top of said phosphor thin film layer and a fluoride containing layer on the bottom of said phosphor thin film layer.

9. The structure of claim 4, wherein said structure is annealed onto a substrate at an annealing temperature of up to about 700°C.

10. The structure of claim 9, wherein said structure is annealed onto a substrate at an annealing temperature of up to about 650°C.

11. The structure of claim 10, wherein said structure is annealed onto a substrate at an annealing temperature of about 600°C.

12. The structure of claim 9, wherein said substrate is selected from the group consisting of glass and glass ceramic.

13. The structure of claim 4, wherein said fluoride containing layer is deposited by electron beam evaporation.

14. The structure of claim 13, wherein said fluoride containing layer is co-deposited with said phosphor thin film.

15. The structure of claim 3, wherein said phosphor thin film layer additionally comprises oxygen.

16. The structure of claim 15, wherein said phosphor thin film layer contains up to about 25 atomic percent oxygen.

17. A thick film dielectric electroluminescent device constructed on a glass or glass ceramic substrate and comprising;

- an europium activated barium thioaluminate or magnesium barium thioaluminate phosphor film, wherein said phosphor film is in contact with at least one fluoride containing thin film.

18. The device of claim 17, wherein said fluoride containing thin film is selected from the group consisting of an alkaline earth fluoride, aluminum fluoride and mixtures thereof.

19. The device of claim 18, wherein said alkaline earth fluoride is selected from the group consisting of barium fluoride and magnesium fluoride.

20. The device of claim 18, wherein said fluoride containing thin film has a thickness of about 5 nm to about 50nm.

21. The device of claim 20, wherein said fluoride containing thin film has a thickness of about 20nm to about 30 nm.

22. The device of claim 21, wherein said phosphor film is represented by $Mg_wBa_{x-w}Al_yS_z:Eu$ where $w = 0 - 0.2$, $x = 1.0$, $y = 2.0 - 6.0$ and $z = 4.0 - 10.0$.

23. The device of claim 22, wherein said phosphor film has a thickness of about 400nm to about 600nm.

24. The device of claim 22, wherein said phosphor film has oxygen incorporated therein.

25. The device of claim 24, wherein said phosphor film has up to 25% atomic percent oxygen.

26. The device of claim 17, wherein said phosphor film is annealed at a temperature of up to about 700°C.

27. The device of claim 26, wherein said phosphor film is annealed onto said substrate at an annealing temperature of up to about 650°C.

28. The device of claim 27, wherein said phosphor film is annealed onto said substrate at an annealing temperature of about 600°C.

29. A method for making a laminate of a rare earth activated thioaluminate based phosphor and fluoride layer for use in a thick film dielectric electroluminescent device, said method comprising;

i) deposition of a fluoride containing layer onto a glass or glass ceramic substrate incorporating a first set of address lines and a dielectric layer;

ii) deposition of an europium activated barium thioaluminate or magnesium barium thioaluminate phosphor film onto said fluoride layer, wherein said film may optionally have oxygen incorporated therein; and

ii) annealing said phosphor film at a temperature of up to about 700°C.

30. The method of claim 29, wherein said fluoride containing layer is selected from aluminum fluoride and alkaline earth fluoride compounds and mixtures thereof.

31. The method of claim 30, wherein said alkaline earth fluoride compounds are selected from the group consisting of barium fluoride and magnesium fluoride.

32. The method of claim 30, wherein said fluoride containing layer has a thickness of about 20nm to about 50 nm.

33. The method of claim 32, wherein said fluoride containing layer has a thickness of about 20nm to about 30nm.

34. The method of claim 32, wherein fluorine from said fluoride containing layer may partially infuse into said phosphor thin film layer.

30. The method of claim 29, wherein said fluoride containing layer and said phosphor thin film is co-deposited.

31. The method of claim 29, wherein the volume ratio of deposited fluoride to deposited thioaluminate is in the range of about 0.02 to 0.1.

32. The method of claim 26, wherein the volume ratio of deposited fluoride to deposited thioaluminate is in the range of about 0.05 to 0.1.

33. The method of claim 29, wherein said phosphor film is represented by $Mg_wBa_{x-w}Al_yS_z:Eu$ where $w = 0 - 0.2$, $x = 1.0$, $y = 2.0 - 6.0$ and $z = 4.0 - 10.0$.

34. The method of claim 33, wherein said phosphor film has a thickness of about 400nm to about 600nm.

35. The method of claim 34, wherein said phosphor film has oxygen incorporated therein.

36. The method of claim 35, wherein said oxygen is present in an amount of up to about 25 atomic percent.

37. The method of claim 29, wherein said fluoride containing layer is deposited by electron beam evaporation.

38. The method of claim 37, wherein electron beam evaporation is conducted at a rate of about 40-300 Angstroms per minute at a pressure range of about 1 to 5×10^{-7} torr onto a substrate of temperature of about 150°C.

39. The method of claim 38, wherein said substrate is selected from glass and glass ceramic material.